

## **Craig Cogger: Executive Summary of Organic Amendments Research**

The purpose of this review is to evaluate the scientific literature on organic soil amendments to provide a basis for guidelines for compost use in urban soils. It addresses the following questions:

Is there a good scientific basis for the expected benefits of organic amendments?

How long are the organic amendments effective?

How much organic matter should be added to achieve these benefits?

What research is needed to fill important gaps in our knowledge?

### **Effect of organic amendments on soil properties**

*Physical benefits.* Most of the physical benefits attributed to organic soil amendments are strongly supported by research results. Organic amendments have been shown to improve soil porosity, permeability, bulk density, and aggregate stability in a range of soils, environments, and types of amendment. Significant changes in soil physical properties sometimes occur at amendment rates of less than one inch, and effects increase as rates of organic amendments increase. Little research has been done with soils amended at rates of greater than one-third by volume with organic materials.

*Available water.* The effect of organic amendments on plant available water is less clear. Although organic amendments increase total water holding capacity, part of the increase is not available to plants. Also, organic amendments decrease soil bulk density, reducing the amount of available water on a volumetric basis. But, loosening compacted soil and incorporating organic matter can increase the size of the root zone, giving roots access to a larger volume of soil to obtain water.

*Nutrients.* The nutrient benefits of compost amendments are often overlooked. Composts with a C:N ratio of 25:1 or less can provide significant amounts of nitrogen and other nutrients, improving the establishment of turf and landscape plants, and reducing the amount of supplemental nutrients needed. Materials with a high C:N ratio immobilize N, which can retard plant establishment, unless additional N is provided during the period of immobilization.

*Runoff.* Measured improvements in permeability, porosity, and water holding capacity provide indirect evidence that organic amendments are likely to reduce runoff from urban landscapes. The only direct research found was done in western Washington. The direct measurements corroborate the effects of organic amendments on runoff reduction, but there are not enough results to determine appropriate amendment rates from these data alone.

*Longevity of benefits.* Two long-term studies were reviewed. They showed benefits of a single compost application persisting for more than 5 years after the application in temperate climates. In turf areas, decomposition of grass roots can compensate for the loss of amended organic matter over time, while in landscaped areas, decomposition of mulches and plant debris provides a long term source of soil organic matter.

### **Use of organic amendments in urban landscapes**

Most of the research done with organic soil amendments has focused on agricultural soils. Less published research is available on urban soils and landscapes.

*Turf grass.* Most turf publications have focused on sports fields or golf greens with specific soil requirements, with much less research information available that is specific to home lawns. Research has shown that thorough soil and seedbed preparation can reduce runoff on some soils under home lawn conditions, even in the absence of organic amendments. Recommended organic amendment rates across the U.S. range from about 15 to 30% by volume for soils initially low in organic matter. These recommendations appear to be based on research for sports turf and experience with turf management in sports turf and home lawns. Research specific to compost amendments and home lawns is in progress at Penn State, and has shown benefits to compost application at 1 and 2 inch rates incorporated to a depth of 4 to 6 inches. These recommendations are designed to maintain healthy turf; runoff reduction is a side benefit.

*Landscape beds.* Most research with organic amendments for landscape trees and plants has focused on amended planting holes. Few or no benefits were observed. Although no direct research on amended beds was found, known benefits of organic amendments in agricultural soils are expected to extend to landscape beds. Based on available research, amendment at a rate of 1/3 by volume should provide substantial benefits in soil low in organic matter.

### **What we don't know**

What are maximum reasonable rates

Little direct information on compost effects on runoff

The effect of soil preparation alone vs. amendment and preparation

Surface vs. incorporated amendments in landscape beds

Nitrate leaching in landscapes

### **Research needs**

Based on existing research and experience, protocols for soil preparation and site inspection can be developed for urban and suburban landscapes in the Puget Sound area. Some critical research gaps exist and additional research can help strengthen and justify

recommended protocols. Key research needs include: 1) developing a background database comparing soil preparation practices, soil and landscape quality, and runoff potential on existing sites, 2) direct evaluation of organic amendment of landscape beds, 3) evaluating rates of compost amendments for turf establishment, and 4) evaluating the suitability of wood waste materials as soil amendments.